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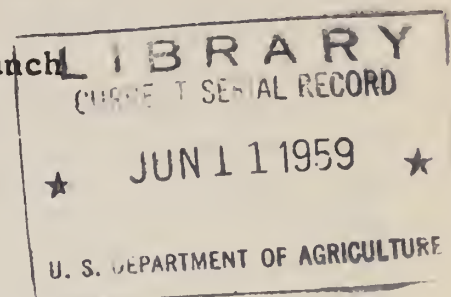
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Further Comparisons of Alfalfa Hay and Alfalfa
Silage for Growing Dairy Heifers ^{1/}

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Previous experiments have shown that heifers fed alfalfa hay as the only forage during the entire growing period were larger than heifers fed only wilted alfalfa silage (1,2,3). The present experiment was conducted to determine the effects of feeding alfalfa silage for limited periods of time during two different intervals in the growing period. It was also designed to determine the ability of heifers to respond to a more adequate ration after the slow rates of growth observed when silage was fed.

The sequence of feeding roughages and the experimental plan is indicated in Table 1. Groups 2 and 3 received silage for a 7 month period but at different ages while group 4 received silage for a 14 month period. From birth to 5 months of age and from 19 to 24 months of age heifers in all 4 groups received the same feeds. The alfalfa forage fed during the experimental period (5-19 mo.) was harvested simultaneously from the same field as hay or as wilted silage.

The feeding schedule while young was similar to that in previous experiments (1, 2, 3). Each heifer received 370 lb. whole milk during the first 2 months of life. A grain mixture containing 15% protein was offered when each calf was 10 days of age and increased up to 3 lb. per day as appetite increased. The amount was reduced to 2 lb. at 6 months and eliminated when 8 months of age. The silage was offered before 10 days of age, and the hay at about 1 month of age after which the calves were fed half hay and half silage (dry matter basis).

At all ages roughages were fed to the limit of appetite. Consumption was recorded daily, and dry matter (D. M.) content of the feeds fed were determined 2 times per month by drying at 80°C in a forced draft oven.

A total of 22 Jersey and 25 Holstein heifers were used in this experiment.

Results

The cumulative body weights of 4 groups at monthly intervals are shown in Figure 1. Body weights at selected ages, gains, intakes, efficiency of gains and statistically homogeneous groupings for specific periods are given in Tables 2 and 3.

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At 5 months of age all groups of heifers were approximately equal in respect to weight, intake and rate of gain (Table 2: Figures 1 and 2). At this age these heifers fed hay and silage were only slightly smaller than heifers fed hay in previous trials (1, 2, 4).

The subsequent body weights of heifers in group 1 were equal to those observed previously when only alfalfa hay was fed to heifers (1, 2, 3, 4). The heifers in group 4 (fed silage) grew at a much slower rate and were similar to those fed silage in previous experiments (1, 2, 3). The heifers in group 3 grew at a very slow rate when silage was fed (5-12 mo.) but at a markedly faster rate when hay was fed (12-19 mo.). The heifers in group 2 grew at a normal rate when hay was fed (5-12 mo.) but at a very slow rate when silage was fed (12-19 mo.).

During the 5 to 12 month interval the 20 heifers fed hay gained faster than the 27 heifers fed silage ($1.27 > 0.68$ lb/day at $P < 0.01$). During the 12 to 19 month age interval the 22 heifers fed hay also gained faster than the 25 heifers fed silage ($1.40 > 0.79$ lb/day at $P < 0.01$).

Markedly increased rates of gain were observed for the heifers of groups 1, 2 and 4 (except group 1, Jerseys) when changed from experimental forage to hay, corn silage and grain at 19 months of age. This increase in growth rate after this ration change was not anticipated in heifers of group 1. It did not occur in heifers of group 3 which had previously been changed from silage to hay.

The body weights at 2 years of age of Holstein heifers in groups 2, 3 or 4 were 100 to 200 lb. less than that of heifers in group 1. The body weights of Holstein heifers in group 1 equaled that of the Beltsville standard after 20 months of age but the body weight of the Holstein heifers in groups 2 and 3 only equaled that of the Ragsdale standard at 2 years of age.

The final weights of the Jersey heifers in groups 1, 2 or 3 were approximately the same, but the weights of heifers in group 4 were 130 lb. less. The equalization of body weights for Jersey heifers in groups 1, 2 and 3 after 19 months of age was due to the elimination of the largest animal from group 1 at 19 months and to a decrease in rate of gain of the remaining heifers in group 1. A reduction in growth rate during this age interval has been noted previously in Jersey heifers reared on hay in this herd (2, 3).

The conclusion appears justified that, under usual conditions, feeding wilted alfalfa silage as the only forage to dairy heifers for any 7 or 14 month interval during the growing period and adequate rations at other times will decrease their weight at 2 years of age.

The weights at 2 years of age of heifers fed silage for 7 month periods, however, were not markedly reduced thus indicating that silage may be usefully employed as the only feed for growing heifers for such periods provided they

have an opportunity to recover from the effects of silage feeding sometime prior to calving.

Differences in voluntary intake paralleled those of gain (Table 1; Figures 1 and 2). During the 5 to 12 month age interval the heifers fed hay consumed more D. M. than those fed silage ($9.81 > 6.84$ lb/day at $P < 0.01$). During the 12 to 19 month age interval the heifers fed hay consumed more than those fed silage ($15.47 > 10.68$ lb/day at $P < 0.01$).

A rapid decrease in intake occurred when the heifers in group 2 were changed from hay to silage, and a fast but less rapid increase occurred for the heifers in group 3 when they were changed from silage to hay. These changes are plotted by 5-day intervals for the month following this change in Figure 2. At both age intervals the rate of increase in consumption as age increased was less for heifers fed silage than it was for heifers fed hay. Each group showed a temporary decrease in dry matter intake when grain was omitted at 8 months of age, and this temporary decrease was more evident in heifers fed silage than with most heifers fed hay.

The efficiency of body weight gains during the 5 to 12 month period was more for the 20 hay fed heifers than it was for the 27 silage fed heifers ($13.02 > 9.49$ lb.gain/100 lb. D. M. at $P < 0.01$). However, during the 12 to 19 month period this was not always the case. The combined breeds averaged 10.45 for group 3; 8.56 for group 4; 7.55 for group 1, and 5.98 for group 2 during this age interval. Reasons are not evident why group 4, continued on silage, was significantly more efficient ($p < 0.01$) than heifers in group 2 which were changed to silage during this period. The caloric value of the body weight gain may not have been comparable for these groups at this age.

The effect of changing from a low rate of intake to a more liberal rate of feeding is evident in the changes in gains, intake and efficiency of group 3 after and before 1 year of age and in groups 2 and 4 after and before 19 months of age.

The efficiency of gain from 5 to 24 months was somewhat higher for heifers in groups 3, 4 and 2 than for those in group 1. These group differences were not significant. Breed differences in efficiency of gain were significant for the entire period as well as for each experimental period ($P < 0.01$).

The average body weight gains were 1.33 and 0.73 lb/day, respectively, when heifers were fed hay or silage. The average daily intakes were 12.64 and 8.77 lb. D. M., respectively, while the average efficiencies were 11.01 and 8.44 lb. gain per 100 lb. D. M. consumed, respectively.

There was a larger variation in the body weight gains, D. M. intake, and efficiency of gain for heifers receiving silage than for heifers receiving hay. This is indicated by the following coefficients of variation:: (a) 34.6 and 10.7% for gains; (b) 13.8 and 12.7% for intake and (c) 26.5 and 12.7% for efficiency of gain by silage and hay fed heifers, respectively. The larger

variation among heifers fed silage than among heifers fed hay has been noticed previously (2, 3). The larger variation in gains and efficiency with approximately equal variation in intake could indicate that there was a large difference in the way silage fed heifers utilized the consumed forage.

Summary

Wilted alfalfa silage was fed to dairy heifers for a 7 month period beginning at 5 or 12 months of age or for a 14 month period beginning at 5 months of age and compared to alfalfa hay fed for similar periods. Growth rate, intake and efficiency of gain were lower for the heifers fed silage. After 19 months of age all heifers were fed a normal ration of hay, corn silage and grain, and the growth rate was increased for most heifers. Body weight at 2 years of age for heifers fed hay during the 14 month experimental period was much greater than that of heifers fed silage. Body weight at 2 years for heifers fed silage for either of the 7 month periods was somewhat less than that of hay fed heifers. These data indicate that silage may provide the major source of feed for dairy heifers for as long as 7 months, either before or after a year of age, provided more adequate rations are supplied following these intervals.

References

- (1) J. F. Sykes, H. T. Converse and L. A. Moore. J. Dairy Sci., 38: 1246. 1955.
- (2) J. W. Thomas, J. F. Sykes and L. A. Moore. ARS 52-52. 1957.
- (3) ibid. J. Dairy Sci., 42: 651. 1959.
- (4) U.S.D.A., ARS. Production Research Report No. 15. 1957.

Table 1 - Sequence of roughages fed to the 4 groups

| Group No. | Roughage Fed | | | |
|--------------|----------------------|------------|-------------|--------------------------------|
| | 1 - 5 mo. | 5 - 12 mo. | 12 - 19 mo. | 19 - 24 mo. |
| 1 | Hay and Silage (1:1) | Hay | Hay | Hay, Corn Sil., 2 lb. grain |
| 2 | " | Hay | Silage | " |
| 3 | " | Silage | Hay | " |
| 4 | " | Silage | Silage | " |
| Period | Pre-expt'l. | Expt'l. | Expt'l. | Recovery |

Table 2 - Body weights, gains, intake and efficiency of heifers fed hay or silage as described in text

| Group 5 | | | | | | | | | |
|--|----------|-------|-------|-------|--------|-------|-------|-------|--|
| Age (months) | Holstein | | | | Jersey | | | | |
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | |
| Body weight (lb.) | | | | | | | | | |
| 5 | 261 | 270 | 261 | 266 | 173 | 177 | 176 | 172 | |
| 12 | 605 | 589 | 466 | 460 | 382 | 402 | 283 | 249 | |
| 19 | 922 | 776 | 851 | 707 | 575 | 512 | 558 | 365 | |
| 24 | 1223 | 1060 | 1125 | 1033 | 686 | 703 | 707 | 570 | |
| Body weight gain (lb/day/calf) | | | | | | | | | |
| 0-5 | 1.16 | 1.24 | 1.22 | 1.21 | 0.80 | 0.83 | 0.80 | 0.83 | |
| 5-12 | 1.60 | 1.49 | 0.95 | 0.91 | 0.97 | 1.04 | 0.50 | 0.36 | |
| st. dev. (\pm) | .16 | .17 | .15 | .22 | .04 | .10 | .14 | .13 | |
| 12-19 | 1.51 | 0.89 | 1.84 | 1.17 | 0.92 | 0.53 | 1.31 | 0.56 | |
| st. dev. (\pm) | .22 | .24 | .22 | .36 | .11 | .38 | .16 | .24 | |
| 19-24 | 1.94 | 1.84 | 1.77 | 1.91 | 0.78 | 1.23 | 0.92 | 1.23 | |
| st. dev. (\pm) | .26 | .41 | .29 | .50 | .09 | .31 | .19 | .26 | |
| Intake (lb. D.M./Calf/day) | | | | | | | | | |
| 5-12 | 12.13 | 11.25 | 8.65 | 8.76 | 7.66 | 8.19 | 5.28 | 4.78 | |
| st. dev. (\pm) | .98 | .51 | .77 | 1.26 | 1.13 | .76 | .83 | .63 | |
| 12-19 | 19.08 | 13.56 | 17.94 | 12.63 | 12.35 | 9.59 | 12.51 | 6.95 | |
| st. dev. (\pm) | 2.93 | 1.45 | 3.22 | 1.67 | 1.94 | 1.82 | 1.18 | 1.05 | |
| 19-24 | 22.62 | 18.11 | 19.78 | 18.98 | 12.98 | 13.82 | 13.60 | 12.26 | |
| 5-24 (total lb.) | 10,118 | 8,074 | 8,691 | 7,676 | 6,066 | 6,034 | 5,870 | 4,444 | |
| Efficiency (lb. Gain/100 lb. D. M. consumed) | | | | | | | | | |
| 5-12 | 13.18 | 13.28 | 10.91 | 10.26 | 12.89 | 12.74 | 9.36 | 7.91 | |
| st. dev. (\pm) | .68 | 2.31 | 1.44 | 1.44 | 1.70 | 1.82 | 1.94 | 2.77 | |
| 12-19 | 7.95 | 6.47 | 10.38 | 9.22 | 7.16 | 5.49 | 10.53 | 7.90 | |
| st. dev. (\pm) | .98 | 1.16 | 1.17 | 2.07 | 1.14 | 2.61 | 1.26 | 3.27 | |
| 19-24 | 8.03 | 10.22 | 8.98 | 10.26 | 6.13 | 8.98 | 6.83 | 10.07 | |
| 5-24 | 9.50 | 9.78 | 9.94 | 9.99 | 8.46 | 8.72 | 9.05 | 8.95 | |
| No. animals | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 7 | |

Table 3 - Rank and statistically homogeneous groupings of calves fed hay or silage (breeds combined)

| | <u>P = 0.05</u> | <u>P = 0.01</u> |
|-----------------------|-----------------|-------------------|
| Body weight at 19 mo. | (1,3) (2) (4) | (1,3) (3,2) (4) |
| Body weight at 24 mo. | (1,3) (3,2) (4) | (1,3,2) (4) |
| Gain 5-12 mo. | (1,2) (3,4) | (1,2) (3,4) |
| Gain 12-19 mo | (3) (1) (4,2) | (3,1) (1,4) (4,2) |
| Intake 5-12 mo. | (1,2) (3,4) | (1,2) (3,4) |
| Intake 12-19 mo. | (1,3) (2,4) | (1,3) (2,4) |
| Efficiency 5-12 mo. | (1,2) (3,4) | (1,2) (3,4) |
| Efficiency 12-19 mo. | (3) (4) (1) (2) | (3) (4,1) (1) (2) |

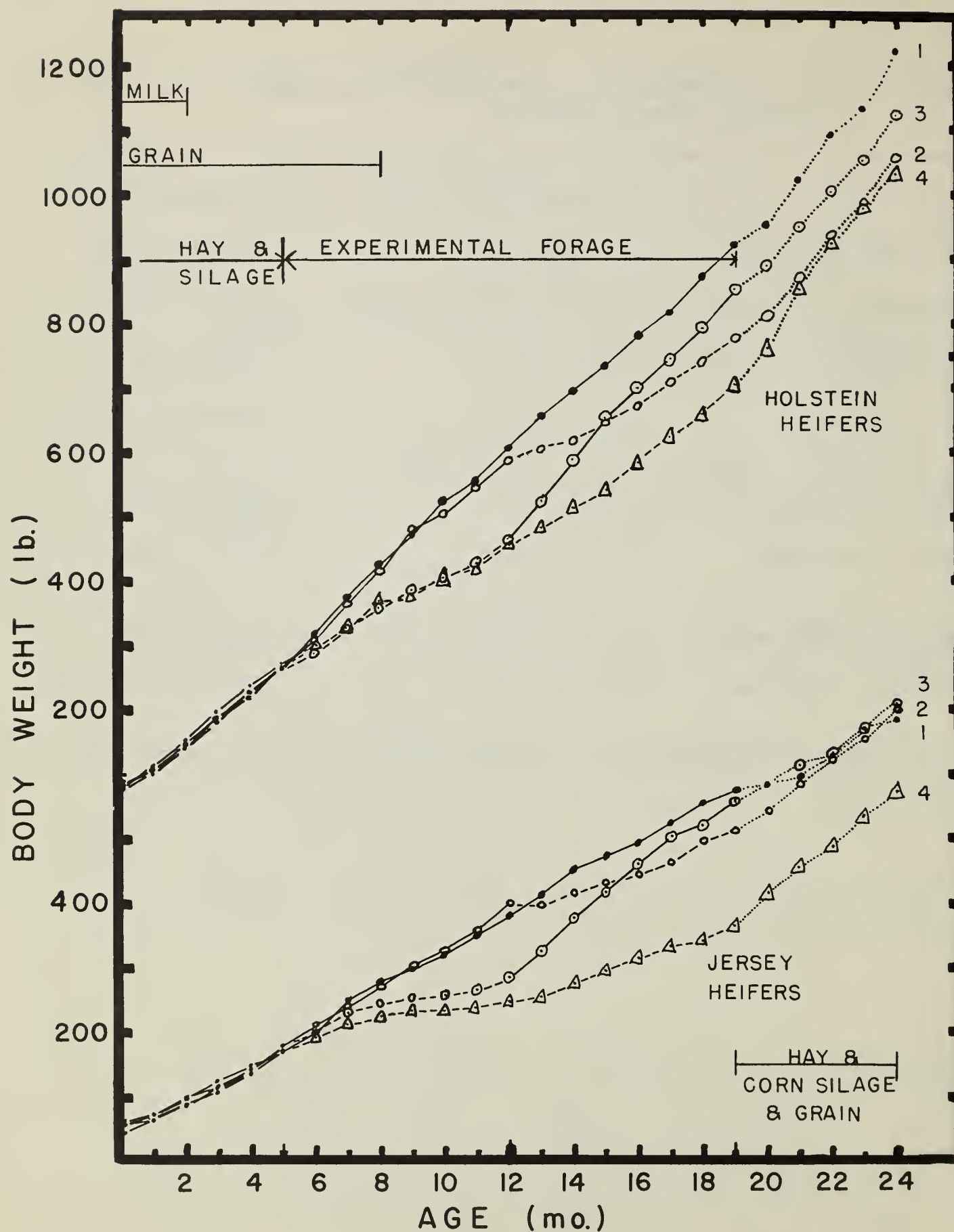


Figure 1 - Average body weights at monthly ages of heifers fed wilted alfalfa silage (dash line) or alfalfa hay (solid line) for given periods as outlined in text and in the figure.

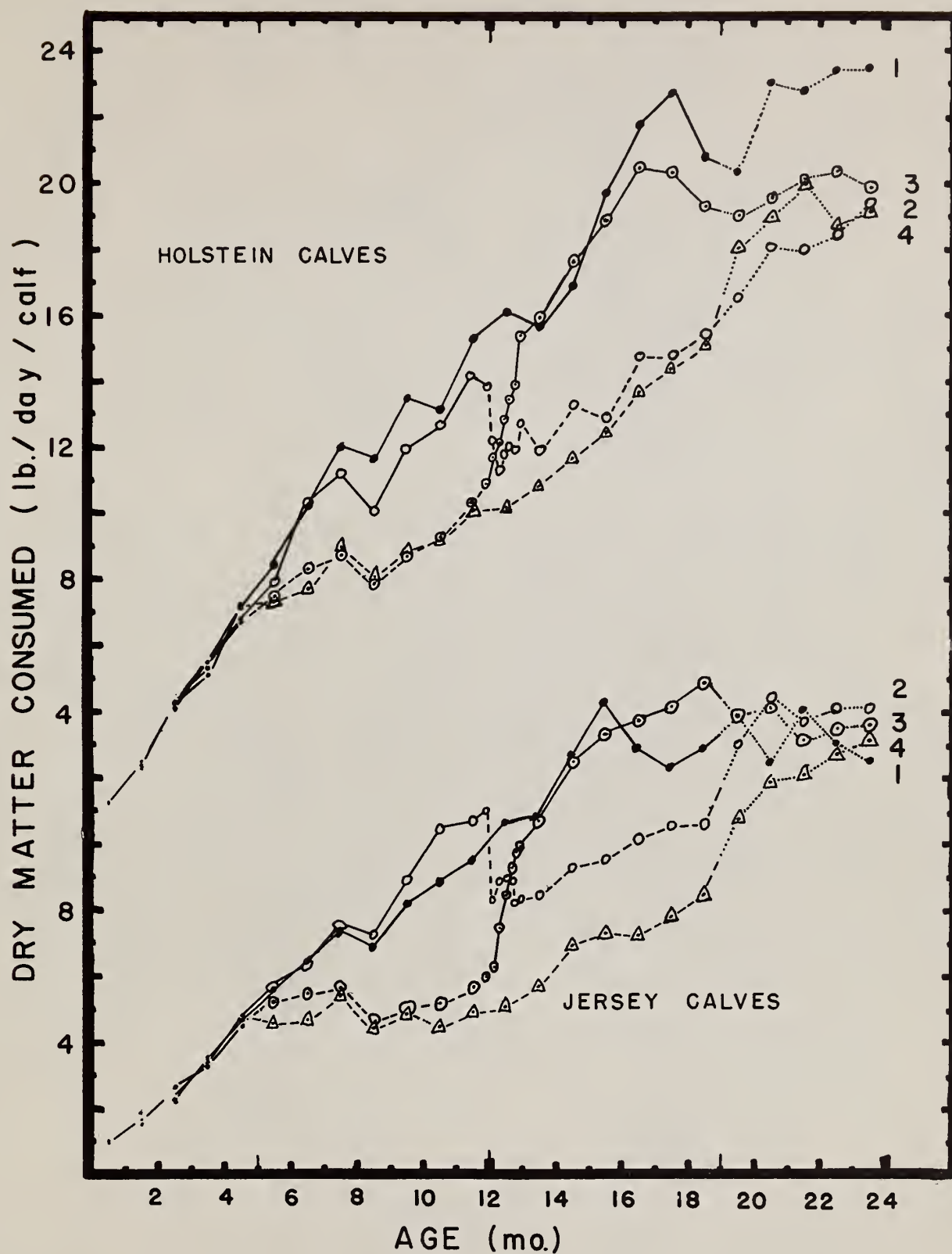


Figure 2 - Average daily dry matter consumed at monthly ages of heifers fed wilted alfalfa silage (dash line) or alfalfa hay (solid line) for given periods as outlined in text and in figure 1.

